THE UNIVERSITY OF HONG KONG
HKU BUSINESS SCHOOL

FINA3350 – Mathematical Finance

GENERAL INFORMATION

Instructor: Dr. Rujing Meng

Email: meng@hku.hk
Office: Room 922 K K Leung Building
Phone: 2859-1048
Consultation times: TBA and by appointments
Semester: 2
Lecture: TBA
Tutor: TBA
Pre-requisites: FINA0301/FINA2322 Derivatives
Co-requisites:/
Mutually exclusive: MATH2906/MATH3906 Financial calculus

Course Website:
Other important details:

Course Description

This course provides students with the necessary mathematical techniques used in continuous-time finance. It covers stochastic calculus, partial differential equation and applied probability. After taking this course, one should be able to fully understand no-arbitrage theory, the Black-Scholes equation, risk-neutral probability and martingales. The purpose of this course is to lay down a solid mathematical foundation for students to learn more advanced topics in financial engineering and risk management, such as exotic options, interest rate derivatives and credit risk models.

COURSE OBJECTIVES

1. to fully understand no-arbitrage theory, risk-neutral probability, martingale, and Black-Scholes equation
2. to lay down a solid mathematical foundation for students to learn more advanced topics in financial engineering and risk management, such as exotic options, interest rate derivatives and credit risk models

FACULTY GOALS

Goal 1: Acquisition and internalization of knowledge of the programme discipline

Goal 2: Application and integration of knowledge

Goal 3: Inculcating professionalism Goal 4:

Developing global outlook

Goal 5: Mastering communication skills

Goal 6: Cultivating leadership

COURSE LEARNING OUTCOMES

Course Learning Outcomes	**Aligned Programme Learning Outcomes**

CLO1 Understand the concept and properties of a standard Brownian motion. Be able to derive probability distribution of a function of Brownian motion.	Goal 1, Goal 2
CLO2 Understand stock price model with a lognormal process. Understand the Ito's Lemma. Be able to derive a process for option price by using the Ito's Lemma.	Goal 1, Goal 2
CLO3 Understand the concept of martingale. Be able to justify whether a process is a martingale or not.	Goal 1, Goal 2
CLO4 Be able to price an option using risk-neutral probability approach.	Goal 1, Goal 2, Goal 4
CLO5 Understand no-arbitrage principle. Be able to derive put-call parity, forward price formula, and the Black-Scholes equation by using the no-arbitrage principle.	Goal 1, Goal 2
CLO6 Understand heat equation and Green's function. Be able to solve the Black-Scholes equation with an arbitrary payoff.	Goal 1, Goal 2, Goal 4
CLO7 Memorize the Black-Scholes formula. Be able to derive Greek letters from the Black-Scholes formula. Understand the asymptotic behavior of the Black-Scholes formula.	Goal 1, Goal 2

COURSE TEACHING AND LEARNING ACTIVITIES

Course Teaching and Learning Activities	**Expected contact hour**	**Study Load (% of study)**
T&L1. Lecture	36 hours	30%
T&L2. Tutorial	12 hours	10%
T&L3. Self-study	72 hours	60%
Total	120 hours	100%

Assessment Methods	**Brief Description (Optional)**	**Weight**	**Aligned Course Learning Outcomes**
A1. Assignments		30%	CLO1 – 7
A2. Exams		60%	CLO1 – 7
A3. Class/Tutorial participation		10%	CLO1 – 7
	Total	100%	

STANDARDS FOR ASSESSMENT

Course Grade Descriptors

A+, A, A-	Students demonstrate very good to excellent performance in the defined assessment criteria.
B+, B, B-	Students demonstrate good to very good performance in the defined assessment criteria.
C+, C, C-	Students demonstrate fair to good performance in the defined assessment criteria.
D+, D	Students demonstrate fair performance in the defined assessment criteria.
F	Students fail to show understanding of core materials in this course.

Assessment Rubrics for Each Assessment

Assessment for each course component is consistent with the course grade descriptors listed above.

COURSE CONTENT AND TENTATIVE TEACHING SCHEDULE

Lecture 1: Introduction and tree approach I
Lecture 2: Tree approach II
Lecture 3: Review of probability
Lecture 4: Stochastic differential equations
Lecture 5: Martingale approach I
Lecture 6: Martingale approach II
Lecture 7: Partial differential equation approach I
Lecture 8: Partial differential equation approach II
Lecture 9: Asymptotic analysis
Lecture 10: Deriving and hedging with Greeks

REQUIRED/RECOMMENDED READINGS & ONLINE MATERIALS (e.g. journals, textbooks, website addresses etc.)

Reference books

- Baxter, Martin, and Andrew Rennie, 1996, Financial calculus: an introduction to derivative pricing, Cambridge University Press.
- Buchanan, J. Robert, 2008, An undergraduate introduction to financial mathematics, 2nd edition, NJ : World Scientific Publishing Company.
- Hull, John, 2011, Options, Futures, & Other Derivatives, 8th edition, Prentice Hall.

MEANS/PROCESSES FOR STUDENT FEEDBACK ON COURSE

○ conducting mid-term survey in additional to SETL around the end of the semester

○ Online response via Moodle site

☑ Others: Course Evaluation at the end of the course (please specify)

COURSE POLICY (e.g. plagiarism, academic honesty, attendance, etc.)

The University Regulations on academic dishonesty will be strictly enforced! Please check the University Statement on plagiarism on the web: **http://www.hku.hk/plagiarism/**

ADDITIONAL COURSE INFORMATION (e.g. e-learning platforms & materials, penalty for late assignments, etc.)